

## REMARKS

Claims 1 to 25 were pending when last examined. Applicant has amended claims 1, 2, 4, 22, and 25. Claims 1 to 25 remain pending.

### Specification

The Examiner objected to equation 2 for being inconsistent with equation 1. Application respectfully traverses and shows how equation 2 is obtained from equation 1 below.

$$f_1 = \frac{0.5r + 0.5b - 1g}{Y} = \frac{0.5r + 0.5b - 1g}{Y} \times \frac{2}{2} = \frac{r + b - 2g}{2Y}.$$

### Claim Objection

Applicant has amended claim 2 to correct the typographical error as requested by the Examiner.

### § 101 Rejections

Applicant has amended claims 22 and 25 as suggested by the Examiner to overcome the rejections under 35 U.S.C. § 101.

### § 103 Rejections

#### Examiner Failed to Answer All Traversed Materials

In the April 14, 2008 Amendment, Applicant traversed and provided substantive arguments against the rejections of claims 1, 4, 7, 8, 11, 12, 14, 15, 16, 17, 19, 20, 21, and 24 in the October 5, 2007 Office Action. In the August 6, 2008 Office Action, the Examiner cited a new reference U.S. Patent No. 7,343,028 ("Ioffe et al.") in combination with previously cited references against independent claim 1. As to dependent claims 4, 7, 8, 11, 12, 14, 15, 16, 17, 19, 20, 21, and 24, the Examiner proceeded to repeat his previous rejections without answering the substance of Applicant's arguments. Applicant note that the Examiner only cited Ioffe et al. against elements of independent claim 1 and not against elements of dependent claims 4, 7, 8, 11, 12, 14, 15, 16, 17, 19, 20, 21, and 24.

“Where the applicant traverses any rejection, the examiner should, if he or she repeats the rejection, take note of the applicant's argument and answer the substance of it.” MPEP § 707.07(f). “Piecemeal examination should be avoided as much as possible. The examiner ordinarily should reject each claim on all valid grounds available ....” MPEP § 707.07(g). Accordingly, Applicant respectfully requests the Examiner to withdraw the August 6, 2008 Office Action because the Examiner repeated his previous rejections without answering the substance of Applicant's arguments. Furthermore, the Examiner provided piecemeal examination where he only rejected claim 1 based on the newly cited Ioffe et al, which is not cited against the elements in the other claims. In view of the above, Applicant respectfully request the refund the extension of time fee for responding to the August 6, 2008 Office Action.

For completeness, Applicant submits a new argument on the patentability of claim 1, and repeats the previous arguments on the patentability of claims 4, 7, 8, 11, 12, 14, 15, 16, 17, 19, 20, 21, and 24.

#### Claims 1, 2, and 22

The Examiner rejected claims 1, 2, and 22 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent Application No. 2005/0047656 (“Luo”) in view of Ioffe et al. Addressing claim 1, the Examiner stated:

Regarding claim 1, Luo discloses a method for removing red eye from an image, comprising: calculating a weighted red value for each pixel in the image based on (1) red, green, and blue color values (pg. 3 [0061-0064] – equation 1 teaches a weighted red value from red, green, and blue, normalized by a total pixel energy); selecting a plurality of pixels in the image having weighted red values greater than a threshold as red eye pixels 88 (fig. 9, page 4 [0065-0072]); and correcting the red eye pixels to remove the red eye from the image (pg. 1 [0009], p. 10 [0128-0129]).

Luo does not expressly disclose based on (2) a luminance of each pixel in the image.

Ioffe discloses a red eye detection method comprising a step to enhance red eye detection by normalizing each pixel by dividing by the average luminance (col. 4 lines 25, 30-31 – average luminance being based on luminance of each pixel). At the time of the invention it would have been obvious to one of ordinary skill in the art to modify the equation to obtain a weighted red value by normalizing by pixel energy as taught by Luo to rather try normalizing by luminance as taught by Ioffe because it would have constituted a substitution of old elements, the combination yielding no more than one would expect from such an arrangement.

Applicant has amended claim 1 to clarify the claimed elements. Specifically, amended claim 1 now recites “calculating a weighted red value for each pixel in the image, wherein the weight red value for a pixel is based on (1) red, green, and blue color values of the pixel and (2) a luminance of the pixel ....” Amended claim 1 (emphasis added). In contrast, Ioffe et al. discloses “normalizing each pixel using the average luminance for a rectangular (or some other shape) neighborhood around the pixel being normalized, for example by ... dividing the pixel being normalized by the average local luminance.” Ioffe et al., col. 4, lines 26 to 32 (emphasis added). Thus, Ioffe et al. does not disclose all the elements of amended claim 1. Lou does not cure the deficiency of Ioffe et al. Accordingly, claim 1 is patentable over the combination of Luo and Ioffe et al. because they fail to disclose all the elements of claim 1.

Claims 2 and 22 depend from amended claim 1 and are patentable over the cited references for at least the same reasons as amended claim 1.

#### Claim 4

The Examiner rejected claim 4 under 35 U.S.C. §103(a) over Luo, Ioffe et al., and U.S. Patent Application No. 2004/0240747 A1 (“Jarman”). The Examiner repeated his previous argument and cited Figs. 2 to 9 and p. 4, paragraphs [0086] to [0091] of Jarman for disclosing different types of weighted red values. Applicant respectfully traverses.

Claim 4 depends from claim 1 and is patentable over the cited references for at least the same reasons as claim 1. In addition, claim 4 is further patentable for the following reason.

Claim 4 recites steps for calculating two types of weighted red values for each pixel. For example, the two types of weighted red values are the weighted purple-red value and the weighted orange-red values disclosed in the present application.

The cited figures and text of Jarman do not disclose two types of weighted red values for each pixel. Instead, Jarman discloses scanning a row of pixels and determining if a set of pixels corresponds to one of three types of red eye highlights. Specifically, for a Type 1 highlight, Jarman scans a row of pixels and identifies a set of pixels with saturation, lightness, and red hue values that signify rising and falling edges of a highlight. See Jarman, paragraphs [0093] to [0106]. For a Type 2 highlight, Jarman scans a row of pixels and identifies a set of pixels has a saturation pattern

specified in the table of paragraph [0116], and then determine if the set of pixels has a lightness, saturation, and hue pattern specified in the table of paragraph [0117]. See Jarman, paragraphs [0107] to [0120]. For a Type 3 highlight, Jarman searches a first derivate of the lightness of a row of pixels and determines if a set of pixels meets a pattern specified in the table of paragraph [0123]. See Jarman, paragraphs [0121] to [0127].

Lou and Ioffe et al. do not cure the deficiency of Jarman. Thus, claim 4 is patentable over the combination of Lou, Ioffe et al., and Jarman because they fail to disclose all the elements of claim 4.

#### Claims 6, 9, 10, 13, and 18

The Examiner rejected claims 6, 9, 10, 13, and 18 under 35 U.S.C. §103(a) as being unpatentable over Luo, Ioffe et al., and U.S. Patent No. 7,042,505 B1 (“DeLuca”).

Claims 6, 9, 10, 13, and 18 depend from claim 1 and are patentable over the cited references for at least the same reasons as claim 1.

#### Claim 7

The Examiner rejected claim 7 under §103(a) as being unpatentable over Luo, Ioffe et al., DeLuca, and U.S. Patent No. 6,714,665 B1 (“Hanna”). The Examiner repeated his previous argument and cited col. 48, lines 30-63 of Hanna for disclosing determining whether a red eye region is substantially a round pupil as recited in claim 7. Applicant respectfully traverses.

Claim 7 depends from claim 1 and is patentable over the cited references for at least the same reasons as claim 1. In addition, claim 7 is further patentable for the following reasons.

Claim 7 recites steps for determining if a red eye region is substantially a round pupil. The steps include (1) determining a radius that provides the largest difference in weighted red values on the radius and the next radius in a range of radii, (2) setting the determined radius as the pupil radius, (3) determining a first ratio between (a) the number of red eye pixels located in a circle having the pupil radius to (b) the area of the radius, (4) determining a second ratio between (a) the number of red eye pixels located in a ring having the pupil radius as its inner radius and a maximum radius in the range of radii as its outer radius to (b) the area of the ring, and (5) determining a difference between the ratios. When the difference is less than a threshold, then the red eye region is not substantially round.

The cited text of Hanna discloses an entirely different method to determine if a candidate center point is a center point of a circular feature. For each spoke 2250 extending from a candidate center point 2240, Hanna searches for an edge on the spoke that has a magnitude greater than a threshold and an orientation that most closely matches a predicated edge orientation. Hanna next discards edges that are much farther than a median distance from candidate center point 2240. Hanna then determines a cost for candidate center point 2240 based on the remaining edges as follows:

This cost is the sum of the absolute difference between the predicted edge orientation and the measured orientation, multiplied by a normalization factor and added to the sum of the absolute difference between the median radius and the measured radius, multiplied by a normalization factor. .... For a perfect circle, this cost is zero.

Hanna, col. 48, lines 56 to 63. Hanna repeats the above for multiple candidate center points and selects the candidate center point that produces the lowest cost below a threshold as the center point for the eye. As the Examiner can see, Hanna discloses entirely different steps than claim 7.

Luo, Ioffe et al., and DeLuca do not cure the deficiency of Luo. Accordingly, claim 7 is patentable over the combination of Luo, Ioffe et al., DeLuca, and Hanna because they fail to disclose all the elements of claim 7.

#### Claim 8

The Examiner rejected claim 8 under 35 U.S.C. §103(a) as being unpatentable under Luo, Ioffe et al., DeLuca, Hanna, and U.S. Patent No. 7,155,058 ("Gaubatz"). The Examiner repeated his previous argument by asserting that a pixel 804e in Fig. 8 of Gaubatz to be the farthest red eye pixel in a red eye region and concluding that Gaubatz discloses a range of radii from 0.5 to 1.5 times the distance from a geometric center of the red eye region to the farthest red eye pixel. Applicant respectfully traverses.

Claim 8 depends from claim 7 and is patentable over the cited references for at least the same reasons as claim 7. In addition, claim 8 is further patentable for the following reasons.

Claim 8 recites a range of radii used for determining if a red eye region is a substantially round pupil. The range is specified as 0.5 to 1.5 times a distance from the geometric center of a red eye region to the farthest red eye pixel of the red eye region.

Figs. 8 and 9 of Gaubatz illustrate the steps of the method in Fig. 7 for generating a luminance intermediate mask. Gaubatz discloses extracting pixels located along each radial extending from a center 804 to a perimeter 802 of a red eye candidate box 800. Starting from the pixel on the radial that has the lowest luminance, Gaubatz identifies the first pixel that exceeds a predetermined luminance threshold as it moves out on the radial toward perimeter 802. Gaubatz then sets the mask values of the first pixel and subsequent pixels on the radial to 0.

As the Examiner can see, pixel 804e is simply the fifth of seven pixels on a radial 806d. Gaubatz does not disclose determining the farthest pixel of a region, let alone a red eye region formed from red eye pixels, and then determining a range of radii based on the distance from the farthest pixel to the geometric center of the region. Instead, Gaubatz processes all the pixels on each radial extending from center 804 to perimeter 802 of box 800.

Luo, Ioffe et al., DeLuca, and Hanna do not cure the deficiencies of Gaubatz. Accordingly, claim 8 is patentable over Luo, Ioffe et al., DeLuca, Hanna, and Gaubatz because they fail to disclose all the elements of claim 8.

#### Claim 11

The Examiner rejected claim 11 under 35 U.S.C. §103(a) as being unpatentable over Luo, Ioffe et al., DeLuca, and Gaubatz. The Examiner repeated his previous argument and cited Figs. 8 and 9 and col. 15, lines 18 to 57 for disclosing the steps of claim 11 for determining a pupil radius. Applicant respectfully traverses.

Claim 11 depends from claim 10 and is patentable over the cited references for at least the same reasons as claim 10. In addition, claim 11 is further patentable for the following reasons.

Claim 11 recites steps for determining a pupil radius of a red eye region. The steps include determining a radius that provides the largest difference in weighted red values on the radius and the next radius in a range of radii, and setting the determined radius as the pupil radius. Essentially, claim 11 recites comparing weighted red values of corresponding pixels on adjacent circles.

As described above regarding claim 8, Figs. 8 and 9 of Gaubatz illustrate the steps of the method in Fig. 7 for generating a luminance intermediate mask. Gaubatz discloses extracting pixels located along each radial extending from center 804 of box 800. Starting from the pixel on the radial that has the lowest luminance, Gaubatz identifies the first pixel that exceeds a predetermined

luminance threshold as it moves out on the radial toward perimeter 802 of box 800. Gaubatz then sets the mask values of the first pixel and subsequent pixels on the radial to 0. Essentially, Gaubatz discloses comparing the luminance value of the pixels on each radial to a fixed threshold.

Luo, Ioffe et al., and DeLuca do not cure the deficiencies of Gaubatz. Accordingly, claim 11 is patentable over the combination of Luo, Ioffe et al., DeLuca, and Gaubatz because they fail to disclose all the elements of claim 11.

#### Claim 12

The Examiner rejected claim 12 under 35 U.S.C. §103(a) as being unpatentable over Luo, Ioffe et al., DeLuca, Gaubatz, and U.S. Patent Application No. 2005/0196067 A1 (“Gallagher”). The Examiner repeated his previous argument and cited paragraphs [0083] to [0094] of Gallagher for disclosing the term “ $R_D * T_3$ ” as the range of distances recited in claim 12 for determining if two red eye regions are too close to each other as. Applicant respectfully traverses.

Claim 12 depends from claim 11 and is patentable over the cited references for at least the same reasons as claim 11. In addition, claim 12 is further patentable for the following reasons.

Claim 12 recites steps that determine two red eye regions are too close to each other when the distance between them is within a range of 10 to 14 times a pupil radius. On the other hand, the cited text of Gallagher discloses a size limiter 134 that removes pixels that have a distance to the centroid of a red eye defect region greater a second size limit. The second size limit is defined as  $S_{L2} = R_D * T_3 + T_4$ , where  $R_D$  is defined as the distance between red eye defects, and  $T_3$  is a constant between 0.05 and 0.1 (e.g., 0.072). See Gallagher, paragraphs [0083] to [0094]. As the Examiner can see,  $R_D$  is the distance between red eye defects and not a pupil radius, and  $T_3$  is a single constant (e.g., 0.072) instead of a range of values. Furthermore, the suggested values for the single constant (0.05 to 0.1) is very different from the recited range (10 to 14) recited in claim 12.

Luo, Ioffe et al., DeLuca, and Gaubatz do not cure the deficiency of Gallagher. Accordingly, claim 12 is patentable over the combination of Luo, Ioffe et al., DeLuca, Gaubatz, and Gallagher because they do not disclose all the elements of claim 12.

#### Claim 14

The Examiner rejected claim 14 under 35 U.S.C. §103(a) as being unpatentable over Luo, Ioffe et al., DeLuca, and U.S. Patent No. 7,035,461 B2 (“Luo1”). The Examiner repeated his previous argument and found that col. 4, lines 12 to 16 of DeLuca disclose, in a ring having inner and outer radii proportional to a pupil radius of a red eye region, rejecting red eye pixels if the most common color in the red eye region is not within a range of skin colors. The Examiner then found that Fig. 3 and col. 2, lines 5 to 6 of Luo1 disclose generating a histogram, selecting a most common color value in the histogram, and comparing the most common color to a range of threshold skin colors. Applicant respectfully traverses.

Claim 14 depends from claim 13 and is patentable for at least the same reasons as claim 13. In addition, claim 14 is further patentable for the following reasons.

Claim 14 recites steps for determining if a red eye region is close to a facial region. Applicant has amended claim 14 to correct a typographical error. The steps now include generating a histogram for pixels in a ring having inner and outer radii proportional to a pupil radius of the red eye region, selecting a most common color value in the histogram (i.e., the most common color in the ring), comparing the most common color value to a range of skin colors, and rejecting the red eye pixels that form the red eye region when the most common color is not in the range of skin colors. Essentially, claim 14 recites rejecting the red eye region when the most common color of a ring around the red eye region is not a skin color.

The cited text of DeLuca discloses additional tests to determine if a round group of pixels having color indicative of a red eye should be modified to remove the red eye. Specifically, DeLuca discloses determining if there are no other pixels within the vicinity of the grouping having a similar red color, where the vicinity is preferably between two to five times the radius of the grouping. DeLuca also discloses detecting iris pixels around the pupil pixels, and eye white pixels around the pupil pixels. However, DeLuca does not disclose rejecting the grouping when the most common color of a ring around the grouping has a skin color.

The cited figure and text of Luo1 disclose generating a histogram, replacing the value of each bin of the histogram with a weighted average of the value of that bin and the values of its immediate neighbors, finding peak values in the histogram, assigning the peak value to bins that are located closest to it, and generating a segmented image where the pixels have a color equal to the number of



the peak that it was assigned to. Lou1 does not select the most common color out of a histogram to compare it with a range of skin colors.

Luo and Ioffe et al. do not cure the deficiency of DeLuca and Lou1. Accordingly, amended claim 14 is patentable over the combination of Luo, Ioffe et al., DeLuca, and Lou1 because they do not disclose all the elements of amended claim 14.

#### Claim 15

The Examiner rejected claim 15 under §103 (a) as being unpatentable over Luo, Ioffe et al., DeLuca, Luo1, and U.S. Patent Application No. 6,895,112 ("Chen"). The Examiner repeated his previous argument and found that col. 3, lines 34 to 51 of Chen disclose comparing the most common color value in HSV color space to the range of threshold skin colors. Applicant respectfully traverses.

Claim 15 depends from amended claim 14 and is patentable over the cited references for at least the same reasons as amended claim 14. In addition, claim 15 is further patentable for the following reasons.

The cited text of Chen does not disclose any comparison between the most common color values and threshold skin colors. Rather, Chen discloses segmentation of quantized color image according to skin color characteristics based on either the YCbCr or HSV color model. See Chen, col. 3, lines 43-45. The mere mention of YCbCr/HSV color space in Chen does not necessarily motivate one of ordinary skill in the art to modify the previous red eye region detection to further carry out skin tone comparison in the HSV color space.

Lou, Ioffe et al., DeLuca, and Lou1 do not cure the deficiency of Chen. Accordingly, claim 15 is patentable over the combination of Luo, Ioffe et al., DeLuca, Lou1, and Chen because they do not disclose all the elements of claim 15.

#### Claim 16

The Examiner rejected claim 16 under 35 U.S.C. §103(a) as being unpatentable over Luo, Ioffe et al., DeLuca, Luo1, and Gaubatz. The Examiner repeated his previous argument and essentially rejected claim 16 for the same reason as claim 11. Applicant respectfully traverses.

Claim 16 depends from amended claim 14 and is patentable over the cited references for at least the same reasons as amended claim 14. In addition, claim 16 is further patentable for the following reasons.

Similar to claim 11, claim 16 recites comparing weighted red values of corresponding pixels on adjacent circles to determine a pupil radius of a red eye region. On the other hand, Gaubatz discloses comparing the luminance value of the pixels on each radial to a fixed threshold. For similar reasons as claim 11, claim 16 is patentable over the combination of Luo, Ioffe et al., DeLuca, Lou1, and Gaubatz because they do not disclose all the elements of claim 16.

#### Claim 17

The Examiner rejected claim 17 under 35 U.S.C. §103(a) as being unpatentable over Luo, Ioffe et al., DeLuca, Luo1, Gaubatz, and Gallagher. The Examiner repeated his previous argument and essentially rejected claim 17 for the same reason as claim 12. Applicant respectfully traverses.

Claim 17 depends from claim 16 and is patentable over the cited references for at least the same reasons as claim 16. In addition, claim 17 is patentable for the following reasons.

Claim 17 recites that the values of the inner and the outer radii for a ring about a red eye region used to determine if the red eye region is close to a facial region are 4 to 9 times a pupil radius of the red eye region. As discussed earlier with claim 12, Gallagher discloses a second size limit defined as  $S_{12} = R_D * T_3 + T_4$ , where  $R_D$  is defined as the distance between red eye defects, and  $T_3$  is a constant between 0.05 and 0.1 (e.g., 0.072). As the Examiner can see,  $R_D$  is the distance between red eye defects and not a pupil radius, and  $T_3$  is a single constant instead of a range of values. Furthermore, the suggested values for the single constant (0.05 to 0.1) is very different from the recited range (4 to 9) recited in claim 17.

Luo, Ioffe et al., DeLuca, Luo1, and Gaubatz do not cure the deficiencies of Gallagher. Accordingly, claim 17 is patentable over the combination of Luo, Ioffe et al., DeLuca, Gaubatz, and Gallagher because they do not disclose all the elements of claim 17.

#### Claim 19

The Examiner rejected claim 19 under 35 U.S.C. §103(a) as being unpatentable over Luo, Ioffe et al., DeLuca, and U.S. Patent No. 6,204,858 B1 ("Gupta"). The Examiner repeated his

previous argument and found that Fig. 2, col. 2, line 62, and col. 4, lines 42 to 59 of Gupta disclose the steps of claim 19. Applicant respectfully traverses.

Claim 19 recites steps for determining if a red eye region is close to a sclera. The steps include generating a luminance histogram for pixels in a ring having inner and outer radii proportional to a pupil radius of the red eye region, selecting a brightest color in the luminance histogram, determine a ratio between the number of pixels in the ring having the brightest color to the number of red eye pixels within a circle having the pupil radius, and rejecting the red eye pixels that make up the red eye region if the ratio is less than a threshold.

The cited figure and text of Gupta discloses calculating convolutions of circular and ring shaped filters and then applying various tests to determine if the convolutions identified possible red eye candidates (e.g., if the convention values exceed a predetermined threshold). As the Examiner can see, Gupta does not disclose the steps recited by claim 19 for determining if a red eye region is close to a sclera.

Luo, Ioffe et al., and DeLuca do not cure the deficiencies of Gupta. Accordingly, claim 19 is patentable over the combination of Luo, Ioffe et al., DeLuca, and Gupta because they do not disclose all the elements of claim 19.

#### Claims 20 and 21

The Examiner rejected both claims 20 and 21 under 103 (a) as being unpatentable over Luo, Ioffe et al., DeLuca, and Gaubatz. The Examiner repeated his previous argument by essentially rejecting claim 20 for the same reason as claim 11 and finding that Figs. 8 and 9 of Gaubatz disclose the inner and outer radii of a ring a red eye region used to determine if the red eye region is close to a sclera are 2 to 5 times a pupil radius of the red eye region. Applicant respectfully traverses.

Claim 20 depends from claim 19 and is patentable over the cited references for at least the same reasons as claim 19. In addition, claim 20 is further patentable for the following reasons.

Similar to claim 11, claim 20 recites comparing weighted red values of corresponding pixels on adjacent circles to determine a pupil radius of a red eye region. On the other hand, Gaubatz discloses comparing the luminance value of the pixels on each radial to a fixed threshold. For similar reasons as claim 11, claim 20 is patentable over the combination of Luo, Ioffe et al., DeLuca, and Gaubatz because they do not disclose all the elements of claim 20.

Claim 21 depends from claim 20 and is patentable over the cited references for at least the same reasons as claim 20. In addition, claim 21 is further patentable for the following reasons.

Claim 21 recites the values of inner and the outer radii for a ring about a red eye region used to determine if the red eye region is close to a sclera are 2 to 5 times the pupil radius of the red eye region. As described above regarding claim 8, Figs. 8 and 9 of Gaubatz disclose processing all pixels on each radial extending from center 804 to perimeter 802 of box 800 instead of a specific range of radii.

Luo, Ioffe et al., and DeLuca do not cure the deficiencies of Gaubatz. Accordingly, claim 21 is patentable over Luo, Ioffe et al., DeLuca, and Gaubatz because they fail to disclose all the elements of claim 21.

#### Allowable Subject Matter

The Examiner indicated that claims 3 to 5 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claim. Applicant has not amended claims 3 to 5 because Applicant believes their independent claim to be patentable over the cited references.

Applicant thanks the Examiner for allowing claims 23 and 24.

The Examiner indicated that claim 25 would be allowable if amended to overcome the § 101 rejection. Applicant has amended claim 25, which is now in condition for allowance.

## Summary

In summary, claims 1 to 25 were pending in the above-identified application when last examined. Applicant has amended claims 1, 2, 4, 22, and 25. Claims 1 to 25 remain pending. For the above reasons, Applicant respectfully requests the Examiner to withdraw the claim objections and rejections and allow claims 1 to 25. Should the Examiner have any questions, please call the undersigned at (408) 382-0480.

I hereby certify that this correspondence is being mailed transmitted prior to expiration of the set period of time by being transmitted via the Office electronic filing system in accordance with § 1.6(a) (4).

/David C Hsia/  
Signature

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Date

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